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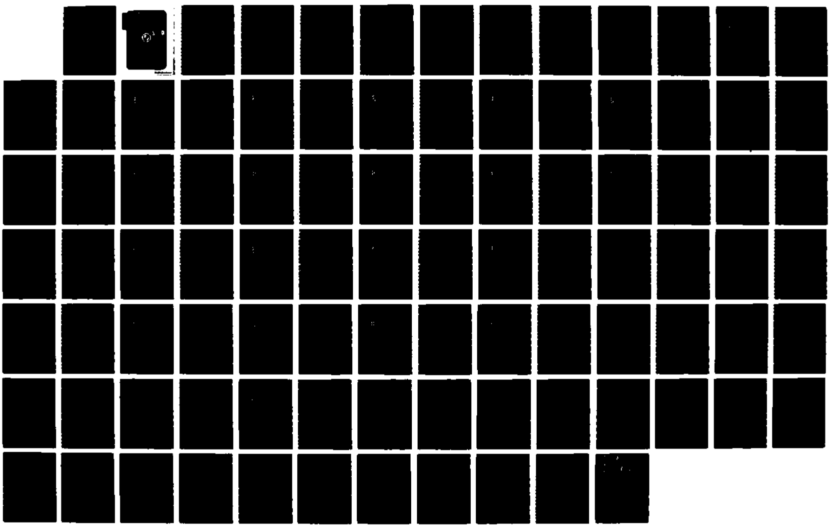

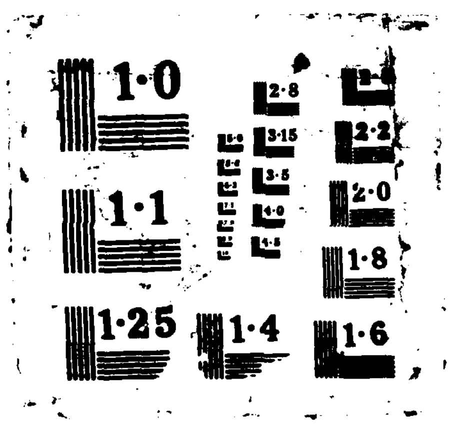
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STUDY REPORT
CAA-SR-87-11

ADF 86-0142



# TRANSPORTATION EVALUATION RESEARCH PROJECT (TERP)



JUNE 1987

PREPARED BY
STRATEGY AND PLANS DIRECTORATE

US ARMY CONCEPTS ANALYSIS AGENCY
8120 WOODMONT AVENUE
BETHESDA, MARYLAND 20814-2797



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The study team evaluated the overall US Army Concepts Analysis Agency (CAA) needs for inter- and intratheater transportation analyses and recommended the type of transportation model best suited to meet those needs. Existing models within the Department of Defense (DOD) community were considered as was the feasibility of development of a new model.

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STUDY REPORT
CAA-SR-87-11

# TRANSPORTATION EVALUATION RESEARCH PROJECT

# (TERP)

June 1987

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| TRANSPORTATION EVALUATION RESEARCH PROJECT (TERP) | STUDY SUMMARY CAA-SR-87-11 |

**THE REASON FOR PERFORMING THE STUDY** is to evaluate the overall US Army Concepts Analysis Agency (CAA) needs for inter- and intratheater transportation analyses and to recommend the type of transportation model best suited to meet those needs.

**THE PRINCIPAL ACCOMPLISHMENTS** of the TERP Study are the determination of:

(1) The strategic mobility analysis process which should be utilized at CAA and the requirements for a transportation model to support this analysis process.

(2) The capabilities and shortfalls of existing Department of Defense (DOD) transportation models when compared to the model requirements in (1) above.

(3) Determination of whether an existing model can fully meet CAA requirements to support the strategic mobility analysis process.

(4) The hardware/software environment and the approximate resources associated with the development of a new model, if required, which would meet the requirements in (1) above.

**THE MAIN ASSUMPTIONS** of this study are:

(1) Requirements for current and near-term transportation analyses can be adequately defined.

(2) The Agency transportation model must be compatible with the Force Evaluation Model (FORCEM), the Agency's theater combat simulation model.

(3) The acquisition of a transportation model which requires a new mainframe computer is not feasible.

**THE PRINCIPAL LIMITATIONS** of this work are:

(1) The capabilities and shortfalls of the models addressed in the study were determined from user's manuals or model operators rather than from first-hand experience by the study team.

(2) The resources associated with new model development are only gross estimates that are based on general model requirements.

**THE SCOPE OF THE STUDY** includes inter- and intratheater transportation analyses and the interface needed between a Continental United States (CONUS)/mobilization model and an intertheater model.

**THE STUDY OBJECTIVES** are:

(1) To determine requirements for transportation analysis at CAA and for a model to support this analysis.

(2) To determine the adequacy of the current transportation analysis process at CAA to meet requirements.

(3) To provide alternate concepts, if necessary, to complement or replace the current transportation process at CAA to meet requirements.

**THE BASIC APPROACH** for the study was to interview selected individuals concerned with transportation analysis both within CAA (leadership, study directors, model operators) and outside CAA (Office of the Secretary of Defense (OSD)), Joint Chiefs of Staff (JCS)) and combine their comments with the Office of the Deputy Chief of Staff for Logistics (ODCSLOG) strategic mobility needs addressed in the Army Strategic Mobility System Assessment (ASMSA) Study to determine the overall need for transportation analysis at CAA and the requirements for a model to support the analysis. Next the model requirements were compared to the capabilities of existing transportation models in use throughout the Army Staff, JCS, and OSD. The existing models were then examined for modification feasibility and compared to new model alternatives to determine the best course of action.

**THE STUDY SPONSOR** was the Director, US Army Concepts Analysis Agency.

**THE STUDY EFFORT** was directed by LTC Philip V. Coyle, Strategy and Plans Directorate.

**COMMENTS AND QUESTIONS** may be addressed to the Director, US Army Concepts Analysis Agency, ATTN: CSCA-SP, 8120 Woodmont Avenue, Bethesda, Maryland 20814-2797.

Tear-out copies of this synopsis are at back cover.

# CONTENTS

# BACKGROUND

The bulk of the strategic mobility analyses conducted at the US Army Concepts Analysis Agency (CAA) to date has been in support of Agency studies which require a deployment to establish an arrival schedule for units to be used in a combat simulation model. The criterion for judging the adequacy of the transportation system has been a comparison of the required versus delivered tonnages and personnel over time. The comparison accounts for voyage attrition.

The primary tool which provides the data used to conduct these analyses has been the Agency's Transportation Model--TRANSMO. The low resolution of TRANSMO has required an aggregation of movement requirement data (e.g., 15 to 20 units in one package for movement), the use of generic ship classes, and the use of relatively few ports to keep the data storage or run time requirements within acceptable limits for the Sperry UNIVAC mainframe. An average run of TRANSMO requires approximately 45 minutes of CPU time. The results from a run of TRANSMO can be replicated as long as the inputs remain constant (deterministic). In selecting which lift asset will be used to move a particular piece of cargo, TRANSMO will choose from among those assets in port or due into the port within a specified number of hours with the objective of choosing the asset which will deliver the cargo to its destination the earliest. Finally, TRANSMO requires that the mode of transportation for each package be designated in the input by the analyst. The model has no capability to select the air or sea mode of transportation for a unit on its own.

The need for higher resolution deployment information has arisen recently with the advent of the Force Evaluation Model (FORCEM) and such studies as the Ultra Fast Sealift Study (UFSS) and the Army Strategic Mobility System Assessment (ASMSA). Arrivals of units by UIC and resupply by class of supply, and arrivals into many ports per theater are necessary to properly utilize the capabilities of FORCEM.

FORCEM is the primary campaign simulation model used at CAA. Ideally, it starts with the arrival of cargo and personnel at the ports of debarkation (PODs) in the theater, processes units and supplies through the ports, simulates their movement to combat and the conduct of the battle. Unit identification code (UIC) level detail is necessary to provide the buildup schedule of divisions and brigades and the arrival of individual combat support/combat service support (CS/CSS) units for use in FORCEM. Also, it is planned

that FORCEM will have the capability in the future to simulate port attrition as part of the combat simulation which will require that lift assets have the capability to be diverted to alternate ports during their voyage.

The determination of the impact on deployments of specific ships is needed for UFSS, and a detailed examination of the many nodes and links of the transportation system is necessary to support the Office of the Deputy Chief of Staff for Logistics (ODCSLOG) requirements specified in the ASMSA Study. Additionally, the ability to model unit arrivals by UIC into the many Continental United States (CONUS) ports will be necessary when a CONUS/mobilization model is eventually built. TRANSMO does not have the capability to meet all these requirements with the responsiveness and transparency needed.

# STUDY PARAMETERS

1. **SCOPE.** The study will examine the overall strategic mobility analysis process at CAA in support of a wide range of studies. An analysis of inter/intratheater strategic mobility will be conducted to include the linkage of the intertheater and CONUS transportation systems. However, the detailed requirements of those activities which should be included in a CONUS transportation model will not be addressed in this study. More follow-on research is required in this area.

2. **OBJECTIVES.** The study objectives encompass more than just the examination of a model to support strategic mobility (STRATMOB) analysis. The objectives are concerned with the entire analysis process which should be used at CAA to support studies which use STRATMOB analysis as input to campaign simulators as well as studies conducted to examine the transportation system itself. How well the current process meets the requirements will be determined, and potential improvements to the analysis process will be recommended.

3. **ASSUMPTIONS.** The assumptions for the study have been kept to a minimum but do presuppose that FORCEM will be the major combat model used at CAA for the foreseeable future. The cost of procuring new computer hardware solely to run a new transportation model is considered infeasible. However, if new hardware on which a new transportation model could be run could also be used to improve the efficiency of computer operations at CAA in general, then the last assumption would not necessarily apply.

US ARMY

CONCEPTS ANALYSIS AGENCY

## ESSENTIAL ELEMENTS OF ANALYSIS (EEA)

1. WHAT ARE THE REQUIREMENTS FOR A MODEL TO SUPPORT THE STRATEGIC MOBILITY ANALYSIS PROCESS AT CAA?

2. TO WHAT EXTENT DO EXISTING MODELS SATISFY THESE REQUIREMENTS?

3. WHAT ARE THE ALTERNATIVES WHICH SATISFY THE REQUIREMENTS DETERMINED IN EEA 1, AND WHAT ARE THE REQUIRED RESOURCES ASSOCIATED WITH EACH?

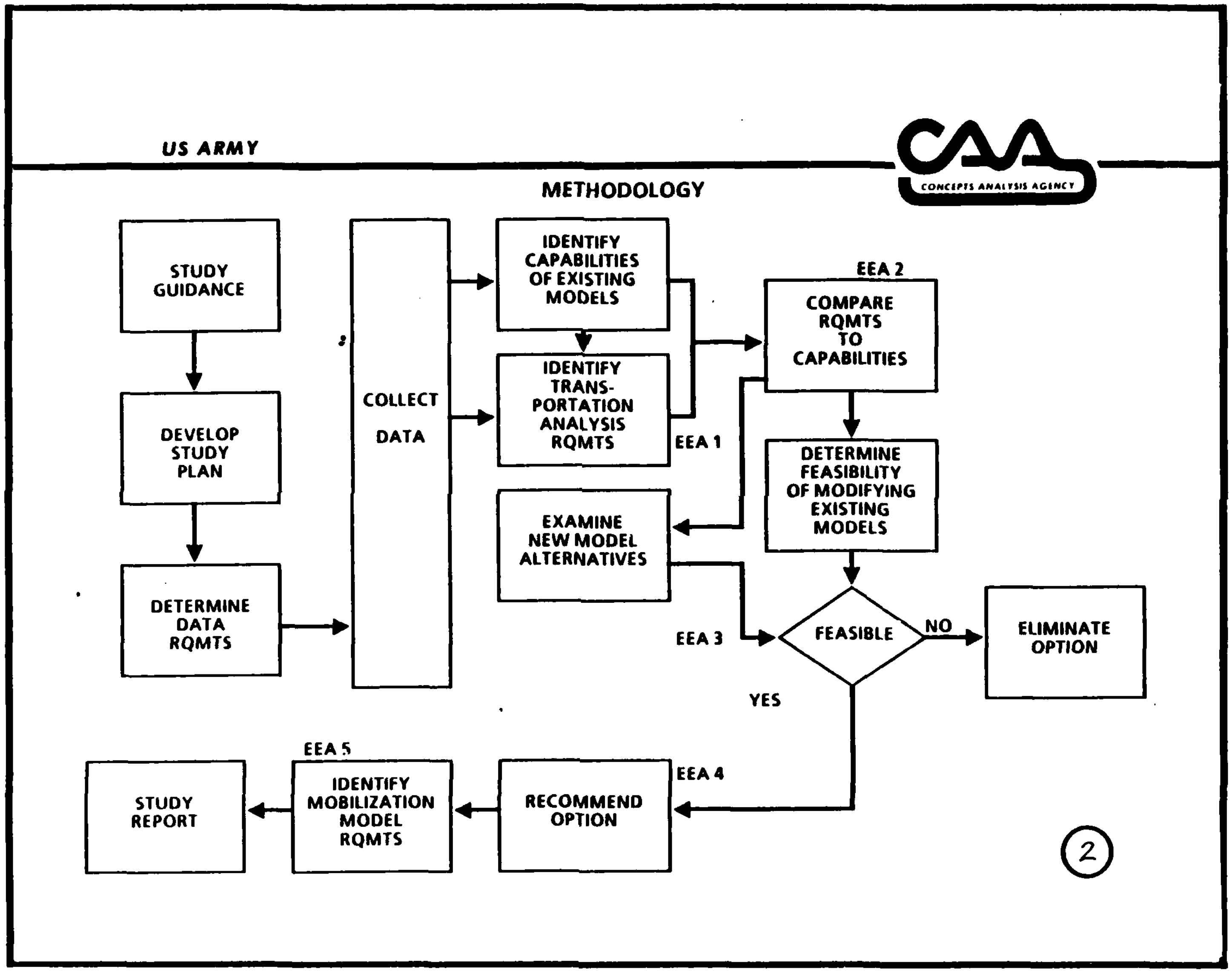
4. WHAT IS THE RECOMMENDED ALTERNATIVE AND THE RATIONALE?

5. WHAT ARE THE REQUIREMENTS FOR A CONUS MOBILIZATION MODEL WHICH WILL INTERFACE WITH THE ALTERNATIVE CHOSEN IN EEA 4?

6

## ESSENTIAL ELEMENTS OF ANALYSIS (EEA)

The questions shown in Chart 1 were identified in order to adequately accomplish the study objectives. The entire STRATMOB analysis process which should be used at CAA must first be determined so the requirements for a model which supports the analysis can be defined. Then the adequacy of current models must be determined to identify candidates that have the potential to satisfy Agency requirements. Feasible candidates for integration into CAA and a new model candidate will be evaluated. The resources needed for each alternative will then be determined along with a recommended course of action. Although the modeling alternatives above apply only to inter and intratheater models (based on study scope), EEA 5 is considered in the context of the overall strategic mobility analysis process.


US ARMY
CONCEPTS ANALYSIS AGENCY
METHODOLOGY
STUDY GUIDANCE
DEVELOP STUDY PLAN
DETERMINE DATA RQMTS
COLLECT DATA
IDENTIFY CAPABILITIES OF EXISTING MODELS
IDENTIFY TRANS-PORTATION ANALYSIS RQMTS
EEA 1
EEA 2
COMPARE RQMTS TO CAPABILITIES
DETERMINE FEASIBILITY OF MODIFYING EXISTING MODELS
EXAMINE NEW MODEL ALTERNATIVES
EEA 3
FEASIBLE
NO
YES
ELIMINATE OPTION
EEA 4
RECOMMEND OPTION
EEA 5
IDENTIFY MOBILIZATION MODEL RQMTS
STUDY REPORT
2

# METHODOLOGY

Chart 2 depicts the process used in the conduct of this study. After receiving the study guidance and developing a study plan, the team determined the data needed for the study. Data were collected from previously documented studies as well as through interviews within CAA (leadership, study directors, model operators) and outside CAA (OSD, JCS) with individuals concerned with STRATMOB issues. The interview results were combined with the transportation needs from ODCSLOG stated in the ASMSA Study to define the overall requirements for transportation analysis. The capabilities of existing models in use or under development were identified using information contained in the user's manuals as well as other pertinent data available. The model requirements then were compared to the capabilities of the existing transportation models. Alternately, given the transportation system requirements, it was possible to consider new model alternatives. From these analyses a recommended option was identified. The study also considered some relevant mobilization requirements pertinent to strategic mobility.

US ARMY

CONCEPTS ANALYSIS AGENCY

## DATA COLLECTION
## STRATMOB ANALYSIS/MODEL CONSIDERATIONS

- CAA LEADERSHIP
  - PORT CONSTRAINTS
  - RETROGRADE
  - LIFT ASSET RESOLUTION
  - PLUG IN - PLUG OUT SCHEDULER
  - TRANSPARENCY
  - DATA MANIPULATION
- STUDY DIRECTORS
  - IDENTIFICATION OF M+10 FORCE BY UIC
  - COMPARISON OF REQUIRED VS DELIVERED CARGO
  - SELF DEPLOYABLE AIRCRAFT
- FORCEM OPERATORS
  - ARRIVAL OF ALL UNITS BY UIC
  - ARRIVAL OF UNITS INTO MULTIPLE PORTS
  - ARRIVAL OF CLASS V AND VII RESUPPLY
- OSD, JCS: MIDAS RESOLUTION A MINIMUM (MANY PORTS, SCHEDULER, MODE SELECTOR, SHIPS BY HULL #)
- ODCSLOG (ASMSA)
  - ASSESS IMPACT OF CHANGES TO TRANSPORTATION SYSTEM
  - RESPONSIVE TO QUICK REACTION STUDIES

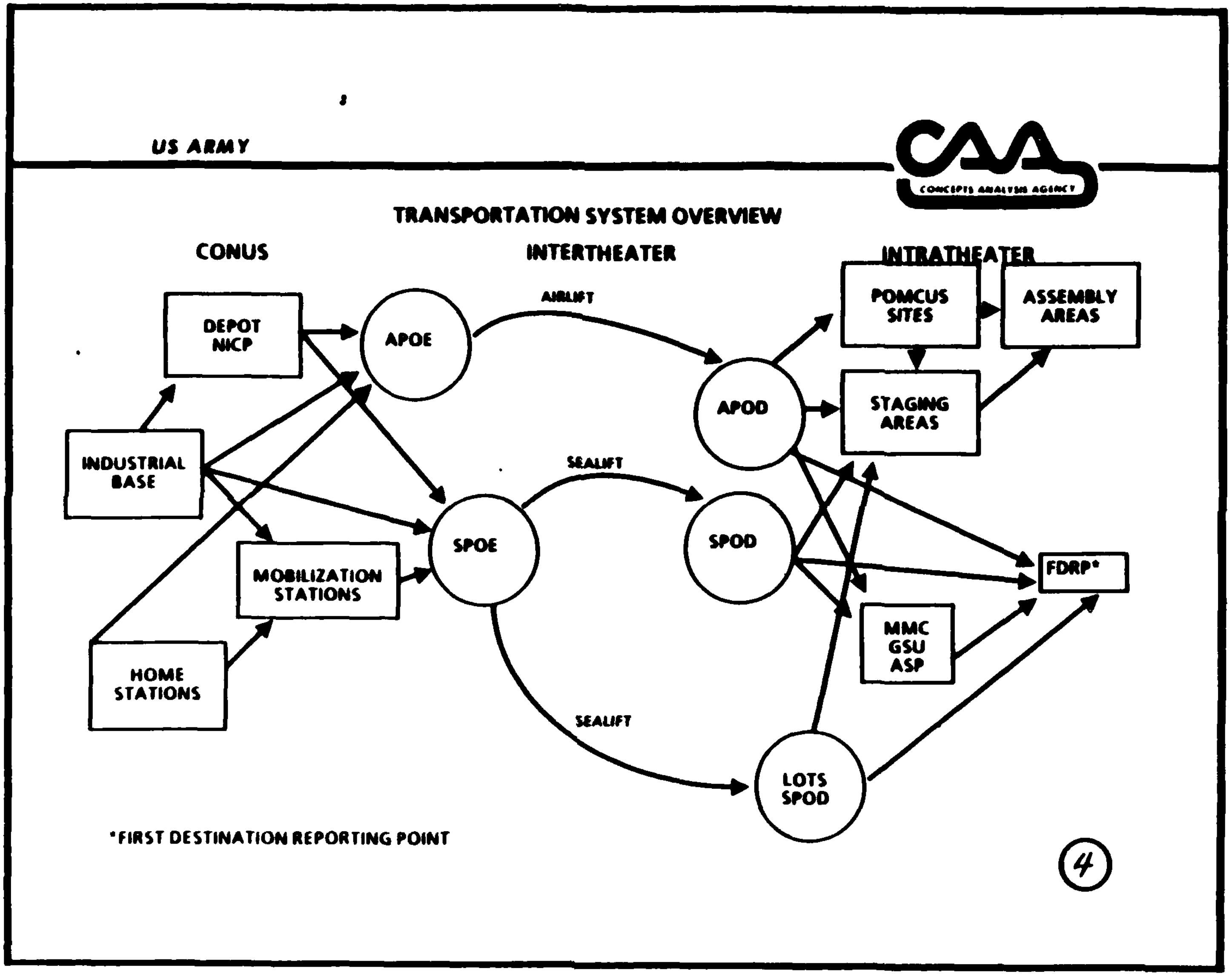
3

# DATA COLLECTION

Chart 3 indicates the major concerns expressed by those interviewed and in the ASMSA Study Report for the level of detail and the types of analyses which should be considered by CAA in the STRATMOB analysis process. Some data relate to model characteristics such as transparency, modular scheduler, responsiveness, and data manipulation. Other data relate to level of detail or resolution such as port constraints, UIC arrivals, and modeling ships by hull number. Finally, the data also indicate the need for CAA to be capable of analyzing the impact of changes to the transportation system, which implies a need for detailed modeling of potential bottlenecks in the system such as ports, lift assets, and scheduling routines. This data collection effort formed the basis for consideration of the types of analysis which should be conducted at CAA as well as the level of detail and operating characteristics which are required in a model to support the analysis.

The next step in the data collection effort was to examine the overall transportation system to identify nodes and links which should be modeled to provide a realistic simulation and to identify potential bottlenecks in the system.

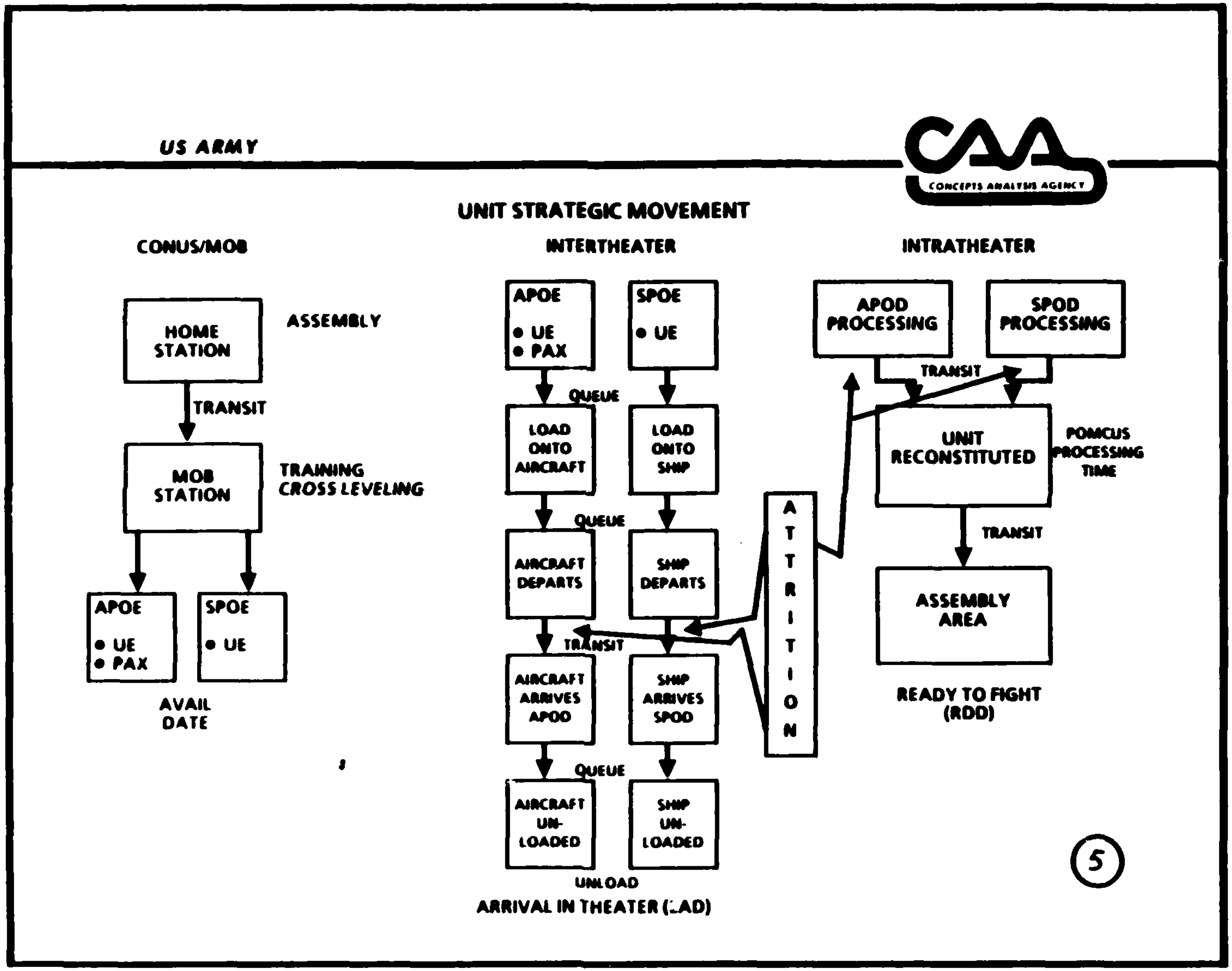
There are two considerations which require elaboration. The notion of a plug-in/plug-out scheduler refers to the idea of having several different scheduling modules that can be interchanged easily from run to run. This would allow the analyst to experiment efficiently with a variety of scheduling algorithms. Secondly, data manipulation refers to the ease of maintaining and updating both the input and output data. It is obviously advantageous to an analyst to quickly and efficiently manipulate data.


US ARMY
CONCEPTS ANALYSIS AGENCY
TRANSPORTATION SYSTEM OVERVIEW
CONUS
INTERTHEATER
INTRATHEATER
DEPOT NICP
APOE
AIRLIFT
APOD
POMCUS SITES
ASSEMBLY AREAS
STAGING AREAS
INDUSTRIAL BASE
SEALIFT
SPOE
SPOD
FDRP*
MOBILIZATION STATIONS
MMC GSU ASP
HOME STATIONS
SEALIFT
LOTS SPOD
*FIRST DESTINATION REPORTING POINT
4

## TRANSPORTATION SYSTEM OVERVIEW

Chart 4 indicates the nodes and links in the transportation system which exist between the origin of a unit or piece of equipment and its final destination prior to employment in an overseas theater. An ideal transportation analysis would account for the time required to process through each node and over each link in estimating the arrival of a movement requirement at any other node throughout the system. Each node or link could produce a bottleneck in the system and would require detailed analysis to help identify and correct the problem. The CONUS portion of the transportation system will not be examined for modeling consideration in this study. However, as shown in the chart, the ports in CONUS provide a logical location for the interface between the CONUS and intertheater modes. This interface will be examined in more detail on the next chart where the movement of a reserve unit is traced from its home station to its assembly area in the theater of operations.

Chart 4 depicts the possible movement of units, equipment, resupply, and replacements from their origins within CONUS to their destinations within the theater of operations. It is important to note that all movement requirements leaving CONUS or entering the theater must go through an airport or seaport. Resupply and equipment originating at a depot or from the industrial base must process through the POEs and compete for lift assets with the units and their equipment. All intertheater movements are transported by either sealift or airlift to the various PODs. Within the theater of operations, units move to the POMCUS sites or staging areas for subsequent movement to their assembly areas. Replacements and resupply, on the other hand, are transported to the Materiel Management Center (MMC), general support unit (GSU), or ammunition supply point (ASP) for subsequent movement to the first destination report point (FDRP) or moved directly to the FDRP.


US ARMY
CONCEPTS ANALYSIS AGENCY
UNIT STRATEGIC MOVEMENT
CONUS/MOB
INTERTHEATER
INTRATHEATER
HOME STATION
ASSEMBLY
TRANSIT
MOB STATION
TRAINING
CROSS LEVELING
APOE
• UE
• PAX
SPOE
• UE
AVAIL DATE
APOE
• UE
• PAX
SPOE
• UE
QUEUE
LOAD ONTO AIRCRAFT
LOAD ONTO SHIP
QUEUE
AIRCRAFT DEPARTS
SHIP DEPARTS
TRANSIT
AIRCRAFT ARRIVES APOD
SHIP ARRIVES SPOD
QUEUE
AIRCRAFT UN-LOADED
SHIP UN-LOADED
UNLOAD
ARRIVAL IN THEATER (LAD)
ATTRITION
APOD PROCESSING
SPOD PROCESSING
TRANSIT
UNIT RECONSTITUTED
POMCUS PROCESSING TIME
TRANSIT
ASSEMBLY AREA
READY TO FIGHT (RDD)
5

## UNIT STRATEGIC MOVEMENT

A reserve unit notified to mobilize would move through the links and nodes/activities as shown on the above chart starting on the left at home station and proceeding through to the assembly area. The times associated with each node or link should be modeled to capture the information necessary to identify the bottlenecks or to explain why units arrive when they do. Attrition is shown during the transit from CONUS to OCONUS and at ports in an overseas theater. Realistically, units would be subject to attrition any time after they leave CONUS. The divisions between the CONUS, inter- and intratheater legs of the movement suggest where different models could interface. The CONUS model would provide an availability date for units at ports of embarkation (POEs). The intertheater model would begin the simulation with units arriving at POEs and terminate after unloading units at ports of debarkation (PODs) (providing arrival dates to compare to latest arrival dates (LADs)). The intratheater model would then begin the simulation with units at PODs and terminate with units at assembly areas (providing arrival dates to compare to required delivery dates (RDDs)). A similar chart would apply to supplies, but with the mobilization station and unit reconstitution activities eliminated.

Chart 5 depicts the movement of a reserve unit from its home station origin to its assembly area destination. It is possible that a reserve unit may have the same home station and mobilization (MOB) station; if this is the case, then the transit between the two stations would be eliminated, and all required processing functions would be accomplished at the MOB station. The unit's final movement in CONUS is its movement to the APOE or SPOE to await final processing and loading. Prior to a unit's intertheater movement, it must process through a series of queues which can further delay a unit's movement. During intertheater movement, a unit is subjected to attrition. Units arriving at the PODs must process through ports and are again subjected to attrition. The attrited units are reconstituted. This reconstitution includes any time required for processing through POMCUS sites. A reconstituted unit is considered to be a force that is ready to fight. The unit then moves to its final assembly area.

The important analysis involves explaining why units arrive when they do, especially when units are late. Only by modeling the activities which cause queues and requiring model reports with queue information can the reasons for lateness be identified. Thus, an accurate picture of a deployment can be obtained by modeling the nodes, links, and activities shown on the above and preceding charts.

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CONCEPTS ANALYSIS AGENCY

## AGENCY STRATEGIC MOBILITY ANALYSIS OBJECTIVES

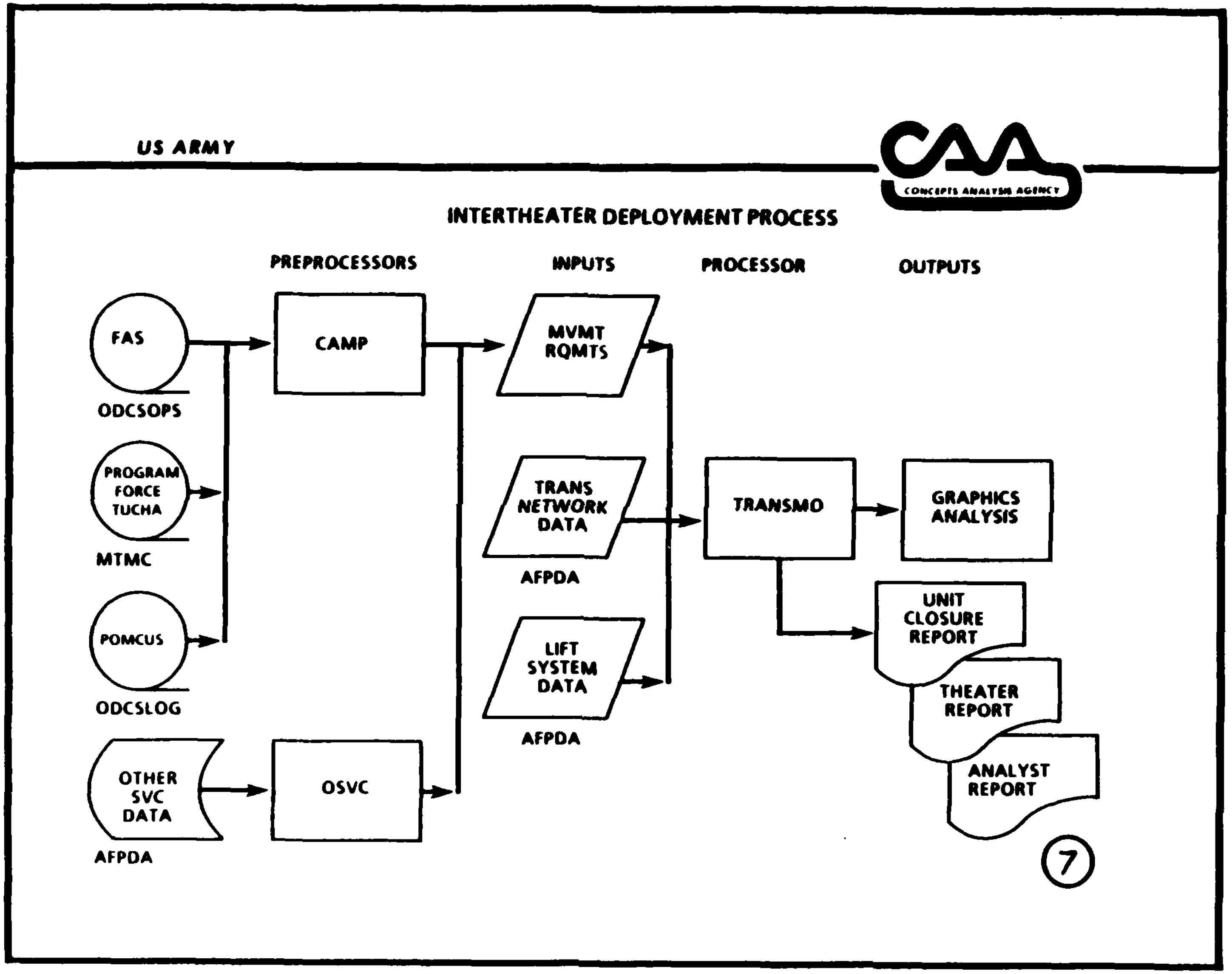
REALISTICALLY SIMULATE FORCE DEPLOYMENT IN ORDER TO:

- PROVIDE ARRIVAL SCHEDULES FOR UNITS AND RESUPPLY CARGO FOR USE IN COMBAT SIMULATIONS
- DETERMINE WHICH FACTORS ARE SIGNIFICANT IN A DEPLOYMENT FROM HOME STATION TO COMBAT ASSEMBLY AREA

6

## AGENCY STRATEGIC MOBILITY ANALYSIS OBJECTIVES

After a review of the steps involved in transporting units from home stations to assembly areas, the STRATMOB analysis objectives were formulated. The objectives apply to analyses in support of Agency studies which use arrival schedules as inputs to combat simulations as well as to pure transportation studies which seek to identify bottlenecks and recommend system improvements. The next few charts will examine the analysis process necessary to accomplish the above objectives.


US ARMY
CONCEPTS ANALYSIS AGENCY
INTERTHEATER DEPLOYMENT PROCESS
PREPROCESSORS
INPUTS
PROCESSOR
OUTPUTS
FAS
ODCSOPS
PROGRAM FORCE TUCHA
MTMC
POMCUS
ODCSLOG
OTHER SVC DATA
AFPDA
CAMP
OSVC
MVMT RQMTS
TRANS NETWORK DATA
AFPDA
LIFT SYSTEM DATA
AFPDA
TRANSMO
GRAPHICS ANALYSIS
UNIT CLOSURE REPORT
THEATER REPORT
ANALYST REPORT
7

## INTERTHEATER DEPLOYMENT PROCESS

Chart 7 is a generic overview of the current process at CAA used to conduct intertheater deployments. The chart pertains to both capabilities and requirements studies. The process starts with units at CONUS ports ready to load. The availability date for these units is provided by the Office of the Deputy Chief of Staff for Operations and Plans (ODCSOPS). The units to be moved and their availability date are identified on a force tape (FAS), and a weight for each unit is then taken from the Program Force Type Unit Characteristics (PFT) File for a non-POMCUS (prepositioned materiel configured to unit sets) unit or the POMCUS Tonnage Report for a POMCUS unit. The Computer Assisted Match Program (CAMP) then computes the time-phased force movement requirements and the resupply needed to support the forces. The CAMP movement requirements are then added to the other service requirements to produce the total movement requirement input file for TRANSMO. Transportation network and lift system data are also input to TRANSMO, and a deployment is then conducted. Various output files are created for use in analyzing the deployment.

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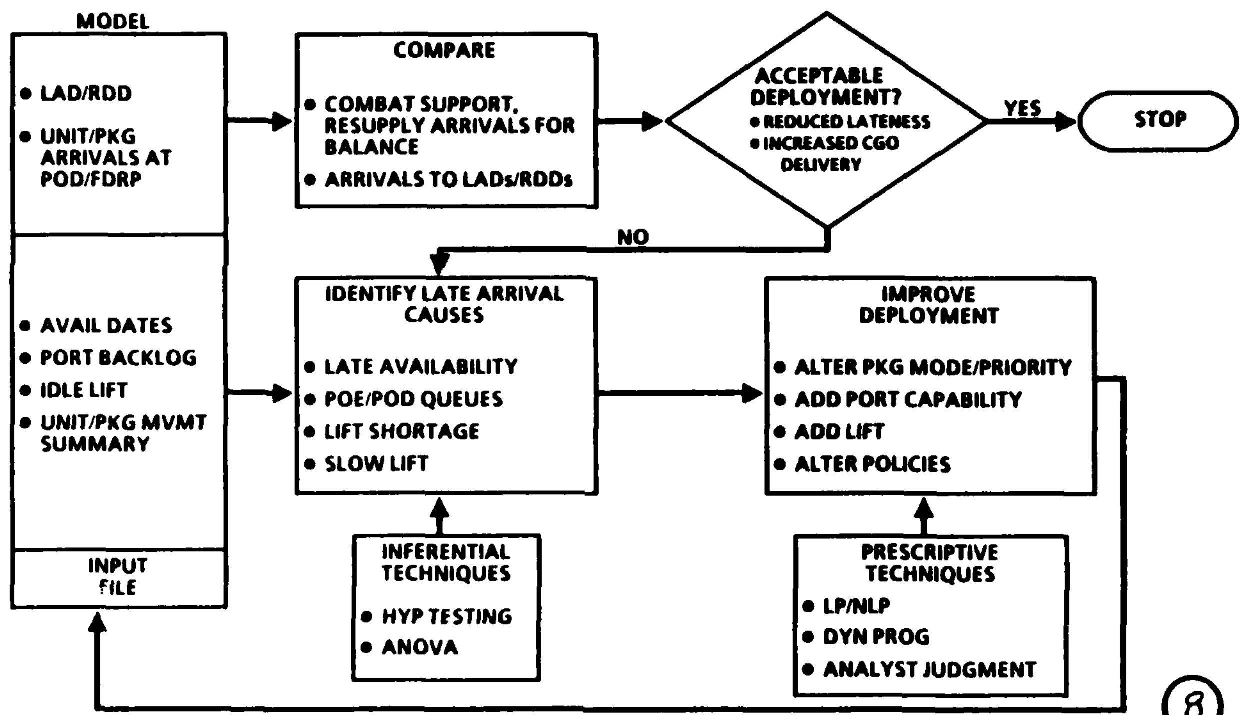
## STRATMOB ANALYSIS PROCESS




8

## STRATMOB ANALYSIS PROCESS

Chart 8 depicts how the analysis process should be conducted and how the model is used to support the analysis. First, the deployment process is simulated in the model to generate output reports providing unit/package arrivals at PODs and first destination reporting points (FDRPs) along with LADs/RDDs for each. The analyst should then make two comparisons--first, the percent delivered versus required (by time period) for combat units, support units, and resupply packages to ensure a balanced deployment; the second is a comparison of arrivals to LADs/RDDs to check for lateness. If the deployment is acceptable (analyst/study director judgment), then the deployment analysis is concluded. If not, a search for causes for late arrivals is made. Several examples of the causes of late arrivals are shown on the chart. Reports from the model are required to identify causes for the lateness, and inferential techniques such as those shown could be used to identify which factors are the most important causes of the lateness. Next, changes are made to the model input file to the factors thought to be causing the lateness. Prescriptive techniques could also be used to show how the factors should be changed to produce the most improvement in the deployment. An example of a prescriptive technique is the use of regression analysis to determine the relative importance of varying factors within a deployment. This iterative process is then continued until an acceptable deployment (or the best we can do) is achieved. To generate the types of reports needed to conduct the required analysis and to make the reports as accurate as possible, the model should meet the requirements stated on the following charts. The requirements will consider model characteristics needed to provide reports which are both valid (simulated the activity accurately) and necessary (needed for a specific portion of the analysis).

US ARMY

CONCEPTS ANALYSIS AGENCY

REQUIREMENTS
SCOPE

- MODEL MOVEMENT OF THE FOLLOWING:
  - UNIT PERSONNEL AND EQUIPMENT
  - RESUPPLY
  - SELF DEPLOYABLE AIRCRAFT
  - EVACUATION/RETROGRADE EQUIPMENT
- MODEL ORIGIN TO ASSEMBLY AREA AND RETURN
  - CONUS MOVEMENT AND MOBILIZATION
  - INTERTHEATER POE TO POD AND RETURN
  - INTRATHEATER POD TO ASSEMBLY AREA AND RETURN
- MODEL AT LEAST 9 THEATERS/CONTINGENCY AREAS SIMULTANEOUSLY PER DG SCENARIO
- MODEL ALL TRANSPORTATION RESOURCES
  - FACILITIES, EQUIPMENT, PERSONNEL
  - PROCEDURES

9

## REQUIREMENTS - SCOPE

The required scope of the modeling effort encompasses all items that must be moved from their origin to their destination (both directions: CONUS to overseas and return). CONUS movement should be modeled to capture the entire transportation system, but definition of the detailed CONUS modeling requirements is beyond the scope of this study. At least nine destination areas are needed because there are nine destinations to which units deploy in the Defense Guidance scenario. In addition, the model should encompass all aspects of transportation necessary to properly ascertain causes of system ineffectiveness and their impact on the transportation system as a whole.

US ARMY

CONCEPTS ANALYSIS AGENCY

## REQUIREMENTS
## REPORTS

- NONGRAPHICAL
  - ARRIVAL DATES FOR ALL UICs AND RESUPPLY PACKAGES
  - DEVIATION OF ARRIVAL DATES FROM LADs/RDDs FOR EACH ROUTE IN THE TRANSPORTATION NETWORK
  - DAILY QUEUE LENGTH AND IDLE LIFT FOR EACH NODE
  - DAILY ACTIVITY REPORT FOR EACH NODE
  - DAILY ATTRITION REPORT
  - DAILY LINK CAPACITY REPORT (INTRATHEATER)
  - LIFT ASSETS USED TO MOVE EACH UNIT/PACKAGE
- GRAPHICAL
  - REQUIRED VS DELIVERED TOTAL CARGO AND PERSONNEL
  - REQUIRED VS DELIVERED UE, PERSONNEL, RESUPPLY
  - REQUIRED VS DELIVERED OTHER SERVICE CARGO
  - COMPARISON OF DELIVERED TONNAGES OF COMBAT UNITS VS CS/CSS UNITS VS RESUPPLY DURING SPECIFIED TIME PERIODS

10

## REQUIREMENTS - REPORTS

The reports generated by the model are the keys to an effective analysis. Those listed in Chart 10 represent the minimum required to ensure that the data is available to the analyst to present a proper picture of the deployment and to identify bottlenecks in the transportation system. The arrival dates for all units and resupply packages are needed as inputs to other models or to establish how well deliveries meet LADs. Daily activity reports for each node and link are needed to identify queue buildups and lift availabilities which are needed to explain why units arrived when they did. The graphical reports are considered the minimum required to display the performance of the transportation system in meeting the required delivery schedule or to balance the three major components of cargo being moved--combat units, support units, and resupply cargo.

US ARMY

## REQUIREMENTS
## INTERTHEATER RESOLUTION

- TIME INCREMENTS - 1 HR FOR AIR
  - 24 HRS FOR SHIPS
  - 180 DAYS DURATION
- MOVEMENT RQMTS - UP TO 25,000 THROUGHOUT THE SIMULATION
  - 15,000 PLANNING FORCE UICs
  - 10,000 RESUPPLY PACKAGES
- LOADING CATEGORIES
  - AIRCRAFT - BULK, OVERSIZE, OUTSIZE, AND PAX
  - SHIPS - STONs, MTONs, AND SQ FT
    - CONTAINERIZABLE
    - NON CONTAINERIZABLE (VEHICLES, AIRCRAFT, OTHER)
- LIFT CATEGORIES
  - AIRCRAFT - 6 TYPES
  - SHIPS - 1200 TYPES (BY HULL NUMBER)

11

## REQUIREMENTS - INTERTHEATER RESOLUTION

While the scope of the model requirements identified CONUS movement and mobilization, the resolution requirements presented in this study will not cover the details of a CONUS model. However, all of the ports which would be modeled in a CONUS model must also be modeled in an intertheater model, since the ports will be the points at which the two models will interface.

Charts 11 and 12 specifically address the intertheater requirements which are necessary to support Agency analysis. The time increments specified are required to account for the varying resolution of the lift assets (i.e., aircraft load in a few hours and ships in 1 to 4 days). It is anticipated that each unit (UIC) will be a package, and the largest force deployed at CAA is the planning force (Mid-Range Force Study) with approximately 15,000 UICs. Lift asset loading data is now provided in the Army Force Planning Data and Assumptions (AFPDA) in the categories shown above, leading to a much more realistic loading activity. The ships should be modeled individually since there can be large differences in capacities among ships of the same category. Aircraft can be modeled by type, however, since aircraft of the same type (C5A, for example) have the same capacities.

US ARMY

## REQUIREMENTS
## INTERTHEATER RESOLUTION (CONTINUED)

- PORTS (AIR AND SEA)
  - OPERATIONS AREAS PER PORT (WAITING, PROCESSING, LOADING, DEPARTURE, MAINTENANCE)
  - NUMBER OF PORTS (AS PER OPLANS)
  - THROUGHPUT CAPACITIES (PAX, STON, MTON, CONTAINERS PER DAY)FOR DEPLOYMENT AND RETROGRADE
  - OTHER CONSTRAINTS (RUNWAY LIMITATIONS, CONTAINER SHIP FACILITIES, ETC.)
- CONVOY SIMULATION
  - SHIPS/ESCORTS PER CONVOY
  - OTHER CONVOY POLICIES (SPEED, TIMING, ROUTES)
- ATTRITION
  - AIR AND SEA RATES BY TIME PERIOD (FORWARD AND RETURN)
  - PORTS (DIFFERENT CAPACITIES OVER TIME)
  - VARIABLE FOR DIFFERENT CLASSES OF LIFT ASSETS

12

## REQUIREMENTS - INTERTHEATER RESOLUTION (CONTINUED)

Ports are prime candidates for bottlenecks in the transportation system, so it is imperative that they be modeled accurately. It is also important that as many of the different ports as possible be modeled in order to simulate specific operational plans.

Since convoy operations have a significant impact on speed of delivery and vulnerability of ships, they should be simulated. Convoys should have varying attrition rates depending on the number of escorts and the size of the convoy.

Finally, the impact of attrition on a deployment is potentially very significant and should be modeled during the voyage and at ports of debarkation.

US ARMY

REQUIREMENTS
INTRATHEATER RESOLUTION

- NUMBER AND TYPES OF TRUCKS, TRAINS, AIRCRAFT AND BARGES
- CARGO LOADING CATEGORIES PER INTERTHEATER MODEL
- UP TO 1000 NODES, 5000 LINKS, AND 25,000 PACKAGES FOR THE LARGEST THEATER (NEED ONLY ONE THEATER AT A TIME)
- NODE/THROUGHPUT LINK CAPACITIES (E.G., STON/MTON PER DAY)

13

# REQUIREMENTS - INTRATHEATER RESOLUTION

The types of lift assets in an intratheater model differ from those in the intertheater model. Different types of trucks and aircraft should be modeled, but generic trains and barges would suffice. The total number of lift assets required to be modeled is unknown at this time and would be scenario-dependent.

The number of nodes and links in the North Atlantic Treaty Organization (NATO) theater is also unknown, but in the testing of one of the models researched, the Southwest Asia (SWA) theater had 500 nodes and 2,500 links. It is estimated that these parameters should be doubled for the NATO scenario.

The throughput link capacities are also much more important in the intratheater case. Each major road has a maximum capacity which should be examined, especially as it interacts with forward and retrograde movements simultaneously.

The number of nodes and links in the transportation system will change over time as the battle progresses. Although there is no intent to model the battle itself in the intratheater model, the effects of the battle on the transportation system could be captured by changing cargo destinations or routes over time as information from the combat model is processed for input to the intratheater model.

US ARMY

CONCEPTS ANALYSIS AGENCY

## REQUIREMENTS
## RESPONSIVENESS

- INTERACTIVE CAPABILITY FOR SMALL, CONSTRAINED ANALYSIS (E.G., PORT THROUGHPUT SENSITIVITY)
- QUICK RESPONSE INTER/INTRATHEATER ANALYSIS (1 HR TURNAROUND)
- OMNIBUS/SRA TYPE ANALYSIS (4 HR TURNAROUND)

14

## REQUIREMENTS - RESPONSIVENESS

It is important that analysts have the capability to perform analyses on issues which require a response in a short time as well as those for which ample time exists. The model should be designed with enough flexibility so that the requirements of the analysis can be accommodated (i.e., quick turn around or long term studies).

For the largest scenarios, such as global deployments, at least two runs per day should be possible. For more constrained problems, such as one theater only, several more runs per day should be achievable, and for a very constrained problem, such as the examination of one port, an interactive response capability should be possible. Such responsiveness will ensure that CAA can react to short notice, quick turnaround studies as well as the long lead time studies such as SRA and OMNIBUS.

US ARMY

REQUIREMENTS
INPUT DATA

- MOVEMENT REQUIREMENTS
  - UNITS - FORCE FILE
  - WEIGHTS - TUCHA, POMCUS TONNAGE REPORT
  - RESUPPLY - JPAM
  - OTHER SERVICE - AFPDA (J4, JCS)
- TRANSPORTATION NETWORK
  - LIFT NODES - AFPDA (J4, JCS), OSD, TPFDD
  - LIFT LINKS - AFPDA (J4, JCS), OSD
  - PORT CHARACTERISTICS - MTMC, JCS, USAF
- LIFT SYSTEM DATA
  - LIFT ASSETS BY YEAR - AFPDA (J4, JCS), FAS/TOE, MTMC
  - LIFT CHARACTERISTICS - AFPDA (J4, JCS), SHIP FILE (MSC), TOE

15

## REQUIREMENTS - INPUT DATA

It is very important to ensure that the input data needed to meet the resolution requirements is available. Chart 15 indicates where the data for each of the model input files can be found.

The movement requirements are composed of units and supplies to be moved. The units are identified on the force tape provided by the study sponsor. The weights for the units are found in the POMCUS tonnage report or the Type Unit Characteristic (TUCHA) File. The resupply requirements are determined each year in the Joint Program Assessment Memorandum (JPAM) Study published at CAA and eventually in AFPDA, along with other service data provided by J4, JCS.

The intertheater nodes and links are provided by J4, JCS and published in AFPDA. The intratheater nodes and links are determined by OSD and used in such models as SUMMITS and SITAP (to be discussed later). The Time Phased Force Deployment Data (TPFDD) is the source of the CONUS port and OCONUS destination for each unit to be deployed. Finally, the port characteristics are published for CONUS seaports by MTMC, for OCONUS seaports by JCS (used in the MIDAS Model), and for all airports by the USAF.

The lift assets available for intertheater movement are published in AFPDA. Lift for intratheater movement would come from the FAS (identifies transportation units) and the TOE file (identifies trucks in each unit). The lift characteristics are published in AFPDA and ship file for intertheater assets and in the TOE file (tonnage movement capability) for intratheater assets.

US ARMY

CONCEPTS ANALYSIS AGENCY

## REQUIREMENTS
## ANALYTICAL TOOLS

- ALGORITHMS WHICH MIRROR THE ACTUAL TRANSPORTATION SYSTEM AS CLOSELY AS POSSIBLE
- LOOK AHEAD CAPABILITY
- DETERMINISTIC SIMULATION WITH STOCHASTIC EXPANSION POTENTIAL
- MODE SELECTION MADE BY MODEL OR THE USER
- CAPABILITY TO INTERFACE WITH DESCRIPTIVE, INFERENTIAL AND PRESCRIPTIVE ANALYSIS TECHNIQUES
- ANALYTIC CAPABILITY TO VARY POLICIES, PROCEDURES, AND OPERATIONAL CAPABILITIES (E.G., LIFT SCHEDULING, CARGO PRIORITIES, PORT CAPACITY)

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## REQUIREMENTS - ANALYTICAL TOOLS

The analytical tools used in the formulation of the model establish the model's validity and provide the analyst with options for conducting the analysis. When actual procedures used in the transportation system can be identified, they should be modeled as accurately as possible. The look-ahead capability is one such procedure which allows the scheduler to look for the best asset for moving a unit among all those available over a range of days rather than just from those in port. The model should be a deterministic simulation, but the potential for a stochastic simulation should be available for studies where stochastic modeling is more appropriate. A deterministic model is simpler, easier to debug and understand, and less data-intensive than a stochastic model. However, the deterministic model has the disadvantage of not allowing for uncertainty analysis. The model logic should be available to allow either the model or the analyst to determine the mode of transport to arrive units as close to their LADs as possible. The model should be able to interface with offline analysis techniques which either identify significant factors in the deployment or offer suggestions on the values of variables which may lead to better deployments. Finally, a modular design to simulate various significant operations would allow the analyst to try different techniques and procedures that would greatly enhance the flexibility of the analysis.

US ARMY

CONCEPTS ANALYSIS AGENCY

## REQUIREMENTS
## OPERATING CHARACTERISTICS

- OPERATE ON A MAIN FRAME OR MINICOMPUTER CURRENTLY AT CAA
- OPERATED BY CAA PERSONNEL
- SET UP AND OPERATION EASILY UNDERSTOOD WITH MINIMAL MANUAL RESOURCE REQUIREMENTS
- ANALYSIS OF RESULTS NOT MANPOWER INTENSIVE (BUILT-IN OR IN-HOUSE DBMS)
- TRANSPARENT TO USER - ACHIEVE FUNDAMENTAL UNDERSTANDING OF THE MODEL QUICKLY
- EASY TO MAINTAIN AND UPDATE BY CAA PERSONNEL
- TOP DOWN STRUCTURED DESIGN

17

## REQUIREMENTS - OPERATING CHARACTERISTICS

The operating characteristics address the ease of operation and the utility that the model should have. The analyst must understand how the model operates in order to explain how results were obtained rather than just reporting results as modeled. Thus, model transparency is critical. Additionally, the model should lend itself to ease of setup and analysis of results without being manpower-intensive. As changes are required in the model to simulate new techniques or policies, the changing of the code should be a straightforward operation performed by CAA personnel. Finally, the model should have a top-down structural design to provide a logical flow of information and plan for appropriate module interactions. These operating characteristics are particularly important to allow an action officer or analyst to use the model to conduct analysis and also to allow for ease in revision and maintenance. The analyst should not have to be a programer or rely on contractor personnel to operate the model.

US ARMY

CONCEPTS ANALYSIS AGENCY

## REQUIREMENTS DOCUMENTATION

- DESCRIPTIVE - OVERVIEW OF STRUCTURE FOR FUNDAMENTAL UNDERSTANDING
- TECHNICAL - EXACT DESCRIPTION WITH COMPLETE CODE DOCUMENTATION
- UP-TO DATE USER'S MANUAL

18

## REQUIREMENTS - DOCUMENTATION

A fundamental requirement for model understanding is accurate and complete documentation. An executive overview should be available for fundamental understanding. Detailed code documentation should be available for programing changes, and an up-to-date user's manual should be available to properly set up, execute, and use the results of the model. The major algorithms used in the model should be specifically stated. The code itself should be well commented. The capabilities, limitations, and assumptions of the model must be clearly stated so that users understand the implications of model outputs.

US ARMY

CONCEPTS ANALYSIS AGENCY

## REQUIREMENTS COMPATIBILITY

- COMPATIBILITY WITH FORCE MODEL - MUST INTERFACE WITH FORCEM: PROVIDE ARRIVAL SCHEDULE BY UIC AT POD
- COMPATIBILITY AMONG INTER, INTRATHEATER, AND MOBILIZATION MODELS

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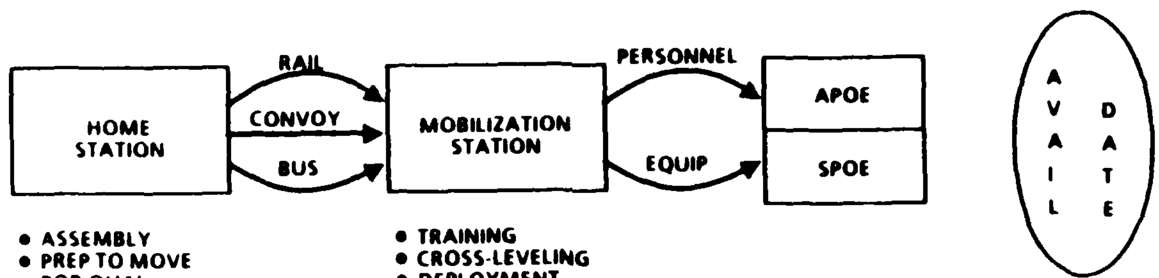
## REQUIREMENTS - COMPATIBILITY

The CAA transportation model must interface with FORCEM. This indicates, as a minimum, that an arrival schedule at the UIC level of detail must be provided at multiple ports of debarkation in each theater. Additionally, if three separate models are used to simulate CONUS, intertheater, and intratheater transportation, then the intertheater model must interface with the other two. As stated earlier, the CONUS-intertheater model interface should be at the CONUS ports.

US ARMY

## CONUS/MOBILIZATION MODEL RQMTS




- ASSEMBLY
- PREP TO MOVE
- POR QUAL

- TRAINING
- CROSS-LEVELING
- DEPLOYMENT VALIDATION
- POR QUAL (cont)

MTMC INPUT

- ROAD/RAIL NETWORK
- NONORGANIC LIFT
  - NUMBER AND TYPES
  - AVAILABILITY SCHEDULE

FORSCOM INPUT (MTBSP*)

- TIME TO PROCESS THROUGH HOME STATION & MOB STATION

*MTBSP Mobilization Troop Bases Stationing Plan

20

## CONUS/MOBILIZATION MODEL REQUIREMENTS

Chart 20 provides an overview of the activities that should be considered in a CONUS transportation model for Reserve or National Guard units. The units report to their home stations, move to their mobilization stations, and then transit to APOEs and SPOEs. There are many more activities not shown which consume time and should be modeled at both the home stations and mobilization stations. The purpose here, however, is to indicate the interface between the CONUS and intertheater models. Both models consider the POEs and should interface at those points. The CONUS model would determine the date when the units arrive at the ports (availability date), and the intertheater model would then process units through the ports and deploy them overseas. Until a CONUS model is available for CAA use; however, the availability dates for units at CONUS ports must be provided by other means.

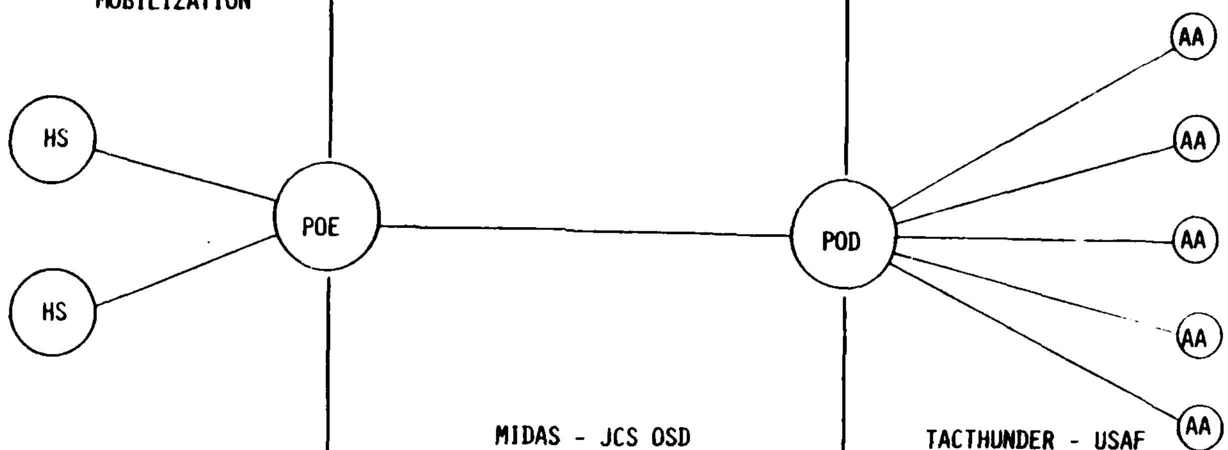
The requirements as stated in this and previous charts define the characteristics of a model or models to support the strategic mobility/transportation analyses performed at CAA. They respond to the first study objective and attempt to answer EEAs 1 and 5 of the study guidelines.

US ARMY

CONCEPTS ANALYSIS AGENCY

## TRANSPORTATION MODEL CANDIDATES

| CONUS MOVEMENT AND MOBILIZATION | INTERTHEATER | INTRATHEATER |
|---|---|---|




| CONUS MOVEMENT AND MOBILIZATION | INTERTHEATER | INTRATHEATER |
|---|---|---|
| | MIDAS - JCS OSD<br>MODES - JDA<br>RAPIDSIM - JCS<br>TRANSMO - CAA<br>TACTHUNDER - LIFT - USAF | TACTHUNDER - USAF<br>SUMMITS - OSD<br>SITAP - JCS |
| MAPS II - MTMC | CFAM - CAA<br>SEACOP - MSC | CFAM - CAA<br>FASTALS - CAA<br>FORCEM - CAA |

21

# COMPARATIVE ANALYSIS

1. **PURPOSE.** The comparative analysis will examine the capabilities of the transportation models in use or being developed within DOD as well as the characteristics which must be considered in new model development. The purpose of the comparative analysis which follows is to examine the extent to which alternatives can meet the CAA transportation model requirements previously discussed. Among the alternatives considered are: new model development, models currently under development, and currently operating models.

2. **CANDIDATE MODELS.** Chart 21 depicts models under development or in use today throughout DOD, JCS, or the Army Staff which are used for transportation modeling (above the dashed line) or which have transportation capability but are not used specifically to model the transportation system (below the dashed line). The models are divided as shown into CONUS, inter-, and intratheater models. Each of the models above the line will be discussed in detail. Those below the line are briefly described on Chart 22 along with the major shortfalls that preclude them from further consideration as CAA transportation models.

US ARMY

# NON TRANSPORTATION MODELS WITH TRANSPORTATION CAPABILITY

| MODEL | CHARACTERISTICS | SHORTFALL |
| --- | --- | --- |
| CONUS | | |
| MAPS II | MTMC MOBILIZATION SIMULATION<br>ROAD NETWORK SOURCE | VALID ONLY FOR CONVOYS<br>NO HOME STATION/MOB STATION |
| INTERTHEATER | | |
| CFAM | LP DESIGNED FOR QUICK REACTION | NO UIC DETAIL/GENERIC SHIPS |
| SEACOP | SEALIFT DEPLOYMENT SIMULATION FOR MSC<br>SCHEDULING ROUTINE SOURCE | SHIPS ONLY/18 HR RUN TIME |
| INTRATHEATER | | |
| CFAM | LP DESIGNED FOR QUICK REACTION | NO UIC DETAIL |
| FASTALS | DESIGNED TO GENERATE UNIT RQMTS<br>TRANSPORTATION NETWORK SOURCE | UNIT MOVEMENT NOT MODELED |
| FORCEM | DETERMINISTIC THEATER COMBAT SIMULATION<br>TRANSPORTATION NETWORK SOURCE | MANPOWER INTENSIVE<br>NO QUICK RESPONSE CAPABILITY<br>NOT DESIGNED FOR AO USE |

22

# NONTRANSPORTATION MODELS WITH TRANSPORTATION CAPABILITY

Each of these models has some transportation capability which was examined for applicability to an Agency strategic mobility model. The primary descriptive characteristic of the model along with a potential source of information from the model is given as well as the primary shortfall which prevents it from being a candidate for an Agency transportation model. Each model shown considers transportation capability for purposes other than to analyze the transportation system or conduct a deployment. Overall, they do not consider factors important in a transportation analysis or do not provide the resolution needed in a CAA model.

For example, the Contingency Force Analysis Model (CFAM) is a linear program based model which was designed to provide CAA with an improved analytic capability for developing and evaluating contingency force organizational and operational concepts including the strategic deployment of units, supplies, and equipment to a theater. However, it does not meet the previously stated resolution requirements.

US ARMY

CONCEPTS ANALYSIS AGENCY

## MIDAS

- Intertheater deterministic simulation developed by GRC.
- High resolution.
- Used by OSD and JCS.

| RQMT | CAPABILITY | SHORTFALL |
|---|---|---|
| Scope | PAX, equip, resupply | No aircraft |
| Reports | All required nongraphical | No graphical |
| Resolution | Ships by hull #, max 8,000 mvmt rqmts and 31 seaports, air pipeline, deterministic attrition | No airport constraints<br>No UIC level detail<br>Not enough ports |
| Responsiveness | 2-3 Hours CPU time | Unknown quick response capability |
| Inputs | All data available | None |
| Analytical tools | Mode selection, look-ahead schedule, deterministic simulation | None |
| Operating characteristics | Multics computer, GRC personnel, PL/1 language | Nonop on CAA computer<br>Not easily operated/maintained at CAA<br>Not transparent |
| Documentation | User's manual | Undocumented code. Technical modifications not up to date |
| Compatibility | Limited w/FORCEM<br>Capable of diverting to alt port | No UIC arrivals |

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## MIDAS

Model for Intertheater Deployment by Air and Sea (MIDAS) was developed by the General Research Corporation (GRC) for the Projection Forces and Analytical Support Division (PF&ASD) of the Office of the Secretary of Defense under contract. MIDAS is an intertheater strategic deployment scheduling and simulation model which uses heuristic (rule based) scheduling to select the mode of deployment of each unit in a force, schedules the movement of the units by air or sea, and simulates the activities of the ships, aircraft, port facilities and attrition. MIDAS also schedules the delivery of supplies to the various theaters of operations. The model is a high resolution, modularly designed, structured program which is written in PL/1. MIDAS is operated and maintained by contractors from General Research Corporation (GRC) and is currently being operated on the MULTICS computer, although plans for making the program operational on the VAX 11/780 are in the developmental phase. The model has used in excess of 2 hours of CPU time for the largest, most complex scenarios. Documentation is incomplete, making contractor presence a requirement for both operations and maintenance.

Although considered a high resolution model, MIDAS can accommodate a maximum of only about 8,000 movement requirements--not enough for the UIC resolution needed. The major drawbacks of MIDAS, however, are found in its operating characteristics. Neither PL/1 language expertise nor the MULTICS computer are available at CAA and permanent contractor presence to operate and maintain a model is neither feasible nor desirable. In addition, MIDAS is not transparent. It is difficult to determine why units arrive when they do without well commented code in a language which is easily interpreted and a user's manual which describes the algorithms being used--neither of which is available. MIDAS is, therefore, considered not feasible for modification for CAA use.

US ARMY

## TRANSMO

- Deterministic simulation.
- Low resolution.
- Accommodates air and sealift with attrition.

| RQMT | CAPABILITY | SHORTFALL |
|---|---|---|
| Scope | PAX, equip, resupply, aircraft | None |
| Reports | All required nongraphical | Limited graphical |
| Resolution | 1-Hour time increments, convoys and attrition, all required loading categories | No UIC-level detail<br>Limited number of ports<br>Limited port constraints<br>No individual ships |
| Responsiveness | 1 Hour for global scenario. Quick response for reduced scenario | None |
| Inputs | All data available | None |
| Analytical tools | Limited look-ahead, deterministic simulation | No mode selection<br>Limited flexibility for trans sensitivity analysis |
| Operating characteristics | UNIVAC, FORTRAN | Not easy to maintain/update<br>Not transparent or user friendly |
| Documentation | User's manual<br>Model description | 2 Years out of date |
| Compatibility | Limited w/FORCEM | No diversion capability to alternate ports |

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# TRANSMO

The Transportation Model (TRANSMO) was developed in 1973 as an evolutionary variant of the Preliminary Force Designer - Simulation Allocation Model (PFD-SAM) which was a low resolution, strategic mobility model used to provide an estimated force closure schedule. The model is primarily an intertheater simulation model; however, it has been modified to allow for CONUS and intratheater movements under specific limited conditions. TRANSMO has a very short run time; an average run of the model requires approximately 45 minutes. Output analysis time is usually lengthy due to the lack of automated output reports. The model has undergone many revisions throughout its life cycle in order to continue to meet user requirements, but documentation of the changes has not been kept current.

The major drawbacks to TRANSMO, in addition to its lack of resolution, are its lack of transparency, mode selector and look-ahead schedules. TRANSMO results are sometimes unexpected and unexplainable. The code is not well commented and not easily interpreted by the analyst. With an outdated user's manual, there is no source for clear explanation of the algorithms in use. The lack of a mode selection routine and look-ahead scheduler severely limit the analyst's capability to examine mode and scheduling factors which might improve the overall deployment. TRANSMO is, therefore, considered not desirable as a basis for modification for CAA use.

US ARMY

CONCEPTS ANALYSIS AGENCY

## TAC THUNDER-LIFT

- Deterministic/stochastic simulation under development by CACI for USAF.
- High resolution.
- Currently models only air movements.
- Models attrition explicitly.

| RQMT | CAPABILITY | SHORTFALL |
|---|---|---|
| Scope | PAX, equip, resupply, aircraft | No sea movement |
| Reports | All required nongraphical | No graphical |
| Resolution | Detailed airport constraints and air loading algorithms, all major airports, stochastic air attrition | Untested for large problems<br>No sealift capability<br>Nondeterministic attrition |
| Responsiveness | Unknown - still testing | Unknown |
| Inputs | All data available | None |
| Analytical tools | Look-ahead scheduler, deterministic or stochastic simulation | No mode selector<br>Sealift unknown |
| Operating characteristics | VAX 11/780, SIMSCRIPT II.5<br>Code easily maintained | Unknown ease of operation and transparency |
| Documentation | User's manual | Limited code documentation; technical modifications not up to date |
| Compatibility | Probably w/FORCEM | UIC level unknown |

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## TAC THUNDER-LIFT

TAC THUNDER-LIFT is a high-resolution, intertheater module which is part of the TAC THUNDER Model under development for the US Air Force (USAF). The LIFT portion is capable of being run separately or in combination with the intratheater portion of TAC THUNDER. To date, the model has been used primarily to model the air movements necessary to provide the resupply to the USAF needed to support the air battle modeled in TAC THUNDER. There is no sea movement simulated in the model, though the "hooks" are in the code to allow for the addition of ships, ports, and sea lines of communication. The model has not yet been tested for large problems, making the resolution, responsiveness, transparency, and ease of operation largely unknown.

The priority in development of the entire TAC THUNDER Model to date has gone into the air battle portion of the model, and the USAF has been pleased with its capabilities so far. CACI, the contract developer, has only recently begun additional coding and testing of the LIFT portion of the model. Based on the reported success of the modeling effort in the area where priority has been given, CACI has the potential to produce a model for use at CAA.

US ARMY

CONCEPTS ANALYSIS AGENCY

## RAPIDSIM

- Deterministic simulation developed by GRC for JCS.
- Low resolution.
- Scaled-down version of MIDAS.

| RQMT | CAPABILITY | SHORTFALL |
|---|---|---|
| Scope | PAX, UE, resupply | None |
| Reports | All required nongraphical | No graphical |
| Resolution | Aggregated movement rqmts<br>Max 999 ships<br>Loads by one measurement only | *Does not load by STON/MTON/sq ft*<br>No UIC detail<br>No individual ships |
| Responsiveness | 10 min CPU<br>*Run time proportional to mvmt rqmt* | Not used for high resolution problems |
| Inputs | All data available | None |
| Analytical tools | Mode selection, look-ahead capability, deterministic simulation | None |
| Operating characteristics | VAX or IBM, FORTRAN 77<br>GRC personnel operators | Not user-friendly<br>Not transparent |
| Documentation | User's manual | Not up to date |
| Compatibility | Limited w/FORCEM | No UIC detail |

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## RAPIDSIM

Rapid Intertheater Deployment Simulation (RAPIDSIM) is an extremely low resolution intertheater deployment model primarily used to aid the Joint Chiefs of Staff (JCS) in achieving a rapid simulation of the movement of combat and support units required for a contingency operation. The RAPIDSIM model utilizes transportation resources such as those available in the Military Airlift Command (MAC) and Military Sealift Command (MSC). The model moves combat units, support units, replacement troops and all classes of supply. RAPIDSIM is capable of selecting and assigning a single mode, air or sea, to each unit, which results in the earliest possible delivery of a unit at its port of debarkation. The model also has a look-ahead capability and is able to simulate convoy movement. RAPIDSIM runs on several mainframe computers including the Honeywell DPS8, the IBM 4341, and the VAX 11/780. The model has a relatively short run time; a RAPIDSIM run usually requires less than 10 minutes of CPU time. RAPIDSIM was developed by the General Research Corporation (GRC) and is very similar to MIDAS in structure. In fact, RAPIDSIM is a scaled-down version of MIDAS designed to aggregate MIDAS input data to produce a much more responsive model for use in quick response analyses.

Since MIDAS lacks the needed resolution, RAPIDSIM, by its design, also lacks the resolution required, and modifying it to add resolution capability would only produce another MIDAS. In addition, RAPIDSIM is not transparent and requires up to two months of analyst training to learn the set up of input files. Thus, because of its nontransparency, lack of resolution, and difficulty of operation, RAPIDSIM is considered not feasible for modification for CAA use.

US ARMY

CONCEPTS ANALYSIS AGENCY

## MODES

- LP model under development at Georgia Tech for JDA.
- Low resolution.
- Objective to find optimum arrival schedule.

| RQMT | CAPABILITY | SHORTFALL |
|---|---|---|
| Scope | PAX, equip, resupply, aircraft | None |
| Reports | Under development | None |
| Resolution | Aggregated units, *few ports, generic* ships and planes | *Limited packages, ports, lift assets.* No attrition or convoys. Poorly modeled port constraints. Operating only one theater |
| Responsiveness | Designed for short run times | Untested for large problems Not running for small problems |
| Inputs | All data available | None |
| Analytical tools | LP model, mode selection and look-ahead capability | Not a simulation Limited sensitivity analysis capability |
| Operating characteristics | Honeywell WWMCCS and DPS6/95, COBOL and FORTRAN | Not ported for CAA hardware Sealift portion not working |
| Documentation | User's manual | Other may be insufficient |
| Compatibility | None | No UIC arrivals No ship diversions |

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# MODES

The Mode Optimization and Delivery Estimation System (MODES) Model is a highly aggregated, low resolution model which is designed to maximize flow while minimizing the number of late arrivals. MODES uses a primal-dual linear programing formulation in order to arrive at an optimal arrival schedule. The model has been found to have errors in the shipping algorithms which have prevented the model from simulating sea movements. The model was developed at Georgia Institute of Technology for the Joint Deployment Agency (JDA) and is currently undergoing operational tests at JDA. The model's formulation is unique to strategic mobility models and its credibility remains to be demonstrated. The model's formulation causes some problems in attempting to solve a problem which deploys units, equipment, and resupply to more than one theater of operation. MODES has a fairly short run time for the small test cases that have been run at the JDA.

Since it is essential that the resolution of movement requirements be at the UIC level of detail, it is unlikely that a linear program will have the capability to adequately model all the variables required. Since MODES is still under development, not yet well tested, and designed as a low resolution linear programing model, it is not considered feasible to modify it for CAA use.

US ARMY

CONCEPTS ANALYSIS AGENCY

## INTERTHEATER MODEL COMPARISON

| RQMT | MIDAS | TRANSMO | TAC THUNDER | RAPIDSIM | MODES |
|---|---|---|---|---|---|
| Scope | M | | M | | |
| Reports | M | M | M | M | M |
| Resolution | M | M | M | F* | F |
| Responsiveness | | | ** | | ** |
| *Analytical tools* | | M | M | | |
| Inputs | | | | | |
| Operating characteristics | F | F | ** | F | |
| Documentation | M | M | M | M | |
| Compatibility | M | M | M | F | F |
| Conclusion | F | F | M | F | F |

F = Fails RQMT M - Modifiable Blank = Meets RQMT

*Increasing RAPIDSIM resolution makes another MIDAS.

**Untested.

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# INTERTHEATER MODEL COMPARISON

Chart 28 is a summary of the intertheater models just presented with an M (modifiable), F (Fails RQMT), or blank (meets requirement) for each category of requirement and a conclusion on future potential for each. MIDAS, TRANSMO, and RAPIDSIM fail the requirements in their operating characteristics (transparency, ease of operation, user friendliness). MODES lacks the needed resolution and cannot be modified to add it. TAC THUNDER-LIFT, though untested in several areas, has been given the benefit of the doubt at this point that it could be further developed to meet the requirements. Thus, only TAC THUNDER-LIFT has the potential, with modifications, to meet CAA requirements.

The next series of charts describe the intratheater models which were examined.

US ARMY

CONCEPTS ANALYSIS AGENCY

## SITAP

- Deterministic simulation developed for OSD.
- High resolution.
- Used by Joint Data Systems Support Center and CAA.

| RQMT | CAPABILITY | SHORTFALL |
|---|---|---|
| Scope | PAX, UE, resupply | None |
| Reports | All required nongraphical | No graphical |
| Resolution | 94 Nodes, 258 links, 37 vehicle types in Korea study | Loads assets only one way (STON, MTON, or sq ft) |
| Responsiveness | 4 Hours CPU for 90-day Korean study run on UNIVAC | NATO theater run time much longer |
| Inputs | All data available | None |
| Analytical tools | Mode selection capability | No look-ahead |
| Operating characteristics | WWMCCS or UNIVAC, FORTRAN | Set up and run over 1 month<br>Not transparent or user-friendly<br>Output analysis manpower intensive<br>Difficult to maintain/operate |
| Documentation | User's manual | Not up to date<br>No technical manuals |
| Compatibility | With TRANSMO<br>Probably other intertheater models | None |

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# SITAP

The Simulator for Transportation Analysis and Planning (SITAP) is a high resolution, generalized intratheater transportation simulation designed to allow users to observe the behavior of a broad spectrum of transportation systems. The model was originally designed in 1968 to support strategic mobility studies conducted by the Assistant Secretary of Defense for Systems Analysis. The model has undergone many significant revisions since its initial development. SITAP is a modularized FORTRAN IV model designed on the Honeywell H6000, VAX 11/780 and IBM 4341 computer systems. The model uses a series of decision rules coupled with a simplified mathematical network to simulate the intratheater transportation problem. SITAP is extremely slow in terms of run time, and the user's manual states that processing time is directly proportional to the size of the problem being solved. An average run can be expected to use approximately 60-250 minutes of CPU time. The validity of SITAP has recently been questioned and, in fact, a new version of the model is due to be released in Spring 1987.

As shown on Chart 29, 4 hours of CPU time was needed to run a relatively small Korean problem. The NATO network will be approximately 10 times larger and run for twice as many days, meaning a very long run time. The model is also very difficult to set up and run, as evidenced by CAA's current efforts to link SITAP to TRANSMO in the Transportation Improvement Program Plan (TRIP-P) Study. The output analysis is manpower-intensive, and the model lacks transparency. It is, therefore, considered infeasible for modification for CAA use.

US ARMY

CONCEPTS ANALYSIS AGENCY

## SUMMITS

- Deterministic simulation under development by GRC for OSD.
- High resolution.
- Designed to interface with MIDAS.

| RQMT | CAPABILITY | SHORTFALL |
|---|---|---|
| Scope | PAX, UE, resupply | None |
| Reports | All required nongraphical | No graphical |
| Resolution | 500 Nodes, 2600 links, 30K packages, 180-day war in SWA. 125 Nodes, 50K packages for NATO Central | Large no. of nodes and packages untested in combination |
| Responsiveness | 4-5 hours CPU for SWA<br>8 hours for NATO | Unknown run time for NATO w/needed resolution |
| Inputs | All data available | None |
| Analytical tools | Mode selection and look-ahead capability | None |
| Operating characteristics | Multics, FORTRAN, GRC personnel | Not ported for CAA hardware, not easy to learn, unknown transparency or code maintainability |
| Documentation | | No user's manual |
| Compatibility | Links w/MIDAS<br>Probably w/other intertheater models | None |

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## SUMMITS

The Scenario Unrestricted Mobility Model for Intratheater Simulation (SUMMITS) is a high resolution intratheater model which is currently under development by GRC. The model will be used to simulate the movement of equipment, troops and resupply from an air or sea port of debarkation to a designated destination through a multinodal transportation network in an optimal fashion. It is designed to simulate movement in any theater of operations for which there is theater data and to interface directly with the intertheater model MIDAS. As this model has not been fully developed, there is very little specific data available on model performance. Since it is being designed to link with MIDAS, it will provide an inter/intratheater capability for OSD.

So far, SUMMITS has been tested for a small NATO problem (125 nodes) with a run time of 8 hours. It is likely that with 8 to 10 times more nodes for a realistic NATO simulation the run time will be far too excessive. Additionally, the model is not ported for CAA hardware and is operated by GRC personnel only. There are, therefore, several problems present in the model without considering transparency or ease of operation/maintainability. SUMMITS is thus considered infeasible for modification for CAA use.

US ARMY

## TAC THUNDER (INTRATHEATER)

- Deterministic/stochastic simulation under development by CACI for USAF.
- High resolution.
- Major emphasis on air combat.

| RQMT | CAPABILITY | SHORTFALL |
|---|---|---|
| Scope | PAX, equip, resupply, aircraft | None |
| Reports | All required nongraphical | No graphical |
| Resolution | Detailed airport constraints and air *loading algorithms, all major* airports, stochastic air attrition, generic ground transportation mode | Untested for large problems<br>*Only two vehicle types*<br>Nondeterministic attrition |
| Responsiveness | Unknown - still testing | Unknown |
| Inputs | Available | None |
| Analytical tools | Look-ahead scheduler, deterministic or stochastic simulation | None |
| Operating characteristics | VAX 11/780, SIMSCRIPT II.5<br>Code easily maintained | Ease of operation and transparency unknown |
| Documentation | User's manual | Limited code documentation; technical modifications not up to date |
| Compatibility | Interfaces with TAC THUNDER-LIFT | None |

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## TAC THUNDER (INTRATHEATER)

This is the TAC THUNDER module which simulates the air war and ground transportation system in NATO. The ground system has been tested only for small problems (10 nodes) so far, and only two vehicle types have been used. Many key requirements are unknown since the model has not been tested for a large problem. Since there is no need for the air war to be run when analyzing the transportation system capabilities, a large portion of the code will not be needed. How this affects the overall efficiency of the model is unknown. Much additional testing of the ground transportation system is needed before a proper judgment can be made of the model potential for use at CAA. Currently, however, it is sufficiently early in development to be considered potentially modifiable for CAA needs.

US ARMY

CONCEPTS ANALYSIS AGENCY

## INTRATHEATER MODEL COMPARISON

| RQMT | SITAP | SUMMITS | TAC THUNDER |
|---|---|---|---|
| Scope | | | M |
| Reports | M | M | M |
| Resolution | M | * | M |
| Responsiveness | F | F | * |
| Analytical tools | M | | M |
| Inputs | | | |
| Operating characteristics | F | F | * |
| Documentation | M | M | M |
| Compatibility | | | M |
| Conclusion | F | F | M |

F = Fails RQMT M = Modifiable Blank = Meets RQMT

*Untested

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## INTRATHEATER MODEL COMPARISON

Chart 32 presents a summary of the intratheater models with the same format as in the intertheater case. SITAP and SUMMITS both fail the requirements in terms of responsiveness and operating characteristics, while TAC THUNDER has been untested in those categories but was given the benefit of the doubt once again.

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CONCEPTS ANALYSIS AGENCY

## NEW MODEL CONSIDERATIONS

### ENVIRONMENT

| SOFTWARE | HARDWARE |
|---|---|
| FORTRAN/PL/1 | UNIVAC |
| SIMSCRIPT | VAX |
| OBJ-ORIENTED LANG | SYMBOLICS |
| SYMBOLICS(LISP) | SUN (WORK STATION) |
| SIMKIT | PC |
| ADA | |

### EVALUATION CRITERIA

| | |
|---|---|
| EASE OF USE | USEFUL LIFE |
| EASE OF DEVELOPMENT | COST |
| EASE OF MAINTENANCE | OPERATOR EXPERTISE |
| PORTABILITY | |

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## NEW MODEL CONSIDERATIONS

If a new model is to be designed for CAA use as an inter/intratheater simulation, there are many factors to be considered in addition to meeting the requirements for a model stated earlier. The computer environment (hardware and software) decided upon should offer the most efficient modeling capability yet still ensure that CAA takes advantage of the most up-to-date technology available. The hardware and software examples above need further research to provide the advantages and disadvantages of the many combinations of the two. The evaluation criteria stated in Chart 33 are examples of the criteria which could be used to discriminate among new model alternatives.

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CAA CONCEPTS ANALYSIS AGENCY

## NEW MODEL ALTERNATIVES

**ALTERNATIVE 1**

- WOULD USE PROVEN TECHNOLOGY (LOW RISK)
- PL/I LANGUAGE
- VAX COMPUTER

**ALTERNATIVE 2**

- CO-DEVELOPMENT W/CAA PERSONNEL
- USES OBJECT ORIENTED LANGUAGE
- KEE/SIMKIT
- SYMBOLICS COMPUTER

**ALTERNATIVE 3**

- SIMSCRIPT LANGUAGE
- VAX COMPUTER

**ALTERNATIVE 4**

- CO-DEVELOPMENT W/CAA PERSONNEL
- LISP LANGUAGE
- SYMBOLICS COMPUTER

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## NEW MODEL ALTERNATIVES

The study team examined several new model alternatives to meet Agency requirements. Alternatives that were considered are presented on Chart 34. They vary in terms of their integration of state-of-the-art technology, method of development, computer resources and risk associated with development.

Alternatives 1 and 3 make use of proven technology. They are considered to be low risk alternatives and both use the VAX computer as a host. These alternatives would be either developed external to CAA by a contractor or internally by Agency personnel.

Alternatives 2 and 4, on the other hand, use state-of-the-art technology and would be co-developed by a contractor and CAA personnel. The model development would be considered to be high risk. Both alternatives make use of advanced technology and computer software tools.

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## CONCLUSIONS/RECOMMENDATIONS

### CONCLUSIONS

- NO EXISTING MODELS MEET THE CAA REQUIREMENTS TO SUPPORT THE STRATEGIC MOBILITY ANALYSIS PROCESS.
- CONUS MOBILIZATION IS A COMPLEX ISSUE AND MUST BE ANALYZED IN MORE DETAIL TO ADEQUATELY DEFINE THIS PORTION OF THE TRANSPORTATION SYSTEM.

### RECOMMENDATIONS

- PURSUE THE ACQUISITION OF A NEW MODEL TO SIMULATE BOTH INTER- AND INTRATHEATER TRANSPORTATION.
- INITIATE A FORMAL STATEMENT OF REQUIREMENTS FOR A NEW TRANSPORTATION MODEL IN A FUNCTIONAL DESCRIPTION TO BE USED AS A BASIS FOR A STATEMENT OF WORK (SOW) APPLICABLE TO EITHER CONTRACTOR OR IN-HOUSE DEVELOPMENT.

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## CONCLUSIONS/RECOMMENDATIONS

As shown in the preceding charts, none of the candidate models meet all of CAA's requirements. All of the models, except TAC THUNDER, have shortfalls in resolution or operating characteristics which cannot be corrected without a complete overhaul, and TAC THUNDER is still under development with many unknown characteristics. The best course of action for CAA is to begin the formal process of stating the requirements for a new strategic mobility model. In addition, the Agency should include a complete analysis of the hardware/software combinations available which will be most advantageous to CAA for the next 5 to 10 years with an appropriate resource estimate to develop, operate and maintain the model software/hardware.

CONUS mobilization is an issue with sweeping scope and implications. Because of its complexity of which mobility and transportation are only parts, mobilization must be explored in much greater detail than is presented in this study. However, until this accomplished it should be sufficient for designing and initiating development of an intertheater mobility model to adequately define the interface between the intertheater model and one which would model CONUS mobilization.

# APPENDIX A

## STUDY CONTRIBUTORS

1. **STUDY TEAM**

   a. **Study Director**

   LTC Philip V. Coyle, Strategy and Plans Directorate

   b. **Team Member**

   CPT Daniel M. Gerstein

2. **PRODUCT REVIEW BOARD**

LTC Charles E. Gettig, Jr. Chairman
CPT(P) Mark DeVita
Mr. Joel S. Gordon
Mr. Steven Khan

# APPENDIX B

# STUDY DIRECTIVE

DEPARTMENT OF THE ARMY
US ARMY CONCEPTS ANALYSIS AGENCY
8120 WOODMONT AVENUE
BETHESDA, MARYLAND 20814-2797

REPLY TO
ATTENTION OF

CSCA-SP

0 9 FEB 1987

MEMORANDUM FOR ASSISTANT DIRECTOR, STRATEGY, CONCEPTS AND PLANS DIRECTORATE

SUBJECT: Transportation Evaluation Research Project (TERP)

1. PURPOSE OF STUDY DIRECTIVE. This directive requires the Strategy, Concepts, and Plans Directorate to conduct a study to evaluate the overall Agency needs for inter and intratheater transportation analyses and to recommend the type of transportation model best suited to meet those needs.

2. BACKGROUND.

a. The Strategy, Concepts, and Plans Directorate (SP) currently uses Transportation Model (TRANSMO) to provide strategic deployment analysis support to many CAA studies. TRANSMO was developed in 1973 as an evolutionary variant of the Preliminary Force Designer - Simulation Allocation Model (PFD-SAM) which was a low resolution strategic mobility model used to provide an estimated force closure schedule. Since its initial development, TRANSMO has undergone many revisions in order to continue to meet the needs of its users.

b. The evolution in the needs of TRANSMO users and assorted CAA models plus advances in computer software and hardware capabilities have necessitated that the requirements for a revised transportation modeling environment be examined.

3. STUDY SPONSOR. US Army Concepts Analysis Agency.

4. STUDY AGENCY. Strategy, Concepts, and Plans Directorate, CAA.

5. TERMS OF REFERENCE.

a. Scope. The study will encompass an investigation of the strategic mobility process required at CAA in support of force design, development and capability studies as well as independent transportation studies. The study will examine intra/intertheater strategic mobility analytic requirements.

b. Objective. This study has three objectives:

(1) To determine requirements for transportation analysis at CAA and for a model to support this analysis.

(2) To determine adequacy of the current transportation analysis process at CAA to meet requirements.

CSCA-SP
SUBJECT: Transportation Evaluation Research Project (TERP)

(3) To provide alternative concepts if necessary to complement or replace the current transportation process at CAA in order to meet requirements.

c. Assumptions.

(1) Requirements for current and near term transportation analysis can be adequately defined.

(2) The Agency transportation model must be compatible with FORCEM.

(3) The acquisition of a transportation model which requires a new mainframe computer is not feasible.

d. Essential Elements of Analysis (EEA).

(1) What are the requirements for a model to support the strategic mobility analysis process at CAA?

(2) To what extent do existing models satisfy these requirements?

(3) What are the alternatives which satisfy the requirements determined in EEA 1, and what are the required resources associated with each?

(4) What is the recommended alternative and the rationale?

(5) What are the requirements for a CONUS mobilization model which will interface with the alternative chosen in EEA 4?

e. Environmental and threat guidance.

(1) No threat guidance is needed for this study.

(2) No environmental consequences are envisioned, however, the study agency is required to surface and address any environmental considerations that develop during the course of the study effort.

f. Estimated cost savings and other benefits. A cost-benefit analysis of the possible options will be conducted.

6. RESPONSIBILITIES:

a. SP. Conduct the study; analyze the study results; make recommendations concerning the agency's strategic mobility analysis requirements, write and publish a study report.

b. FO. Determine the Agency's requirements for a CONUS mobilization model and provide the requirements to the study director for inclusion in the study report.

CSCA-SP
SUBJECT: Transportation Evaluation Research Project (TERP)

7. LITERATURE SEARCH. The literature search will include the following areas:

a. Agency studies: ASMSA I, SRA, OMNIBUS, MRFS, LRFS, PFCA, JPAM, TRAC.

b. Models: FORCEM, FASTALS, TRANSMO, MIDAS, MOVER, SHAKER, MODES, SITAP.

c. Defense Technical Information Center (DTIC).

8. REFERENCES:

a. AR 5-5, Army Studies and Analysis, Oct 81.

b. DA PAM 5-5, Guidance for Army Study Sponsor, Sponsor's Study Directors, Study Advisory Groups, and Contracting Officer Representation, Apr 82.

c. CAA, Study Director's Guide, May 86.

9. ADMINISTRATION

a. Support. Funding, facilities, ADPE, and administrative support to be provided by CAA.

b. Milestone schedule.

(1) Final results will be briefed to ARB NLT 31 March 1987.

(2) Study report will be completed NLT 15 May 1987.

c. Study Team is responsible for preparing and submitting DD Form 1498 and final study documents to DTIC.

E. B. Vandiver

E. B. VANDIVER III
Director

# APPENDIX C

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# APPENDIX D

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# GLOSSARY

## ABBREVIATIONS, ACRONYMS, AND SHORT TERMS

| | |
|---|---|
| AFPDA | Army Force Planning Data and Assumptions |
| ASMSA | Army Strategic Mobility System Assessment |
| APOD | aerial port of debarkation |
| APOE | aerial port of embarkation |
| ASP | ammunition supply point |
| CAA | US Army Concepts Analysis Agency |
| CAMP | Computer Assisted Match Program |
| CFAM | Contingency Force Analysis Methodology |
| CONUS | Continental United States |
| CS/CSS | Combat Support/Combat Service Support |
| EEA | Essential Elements of Analysis |
| FAS | force tape |
| FASTALS | Force Analysis Simulation of Theater Administrative and Logistic Support (model) |
| FDRP | first destination reporting point |
| FORCEM | Force Evaluation Model |
| GRC | General Research Corporation |
| GSU | general support unit |
| JCS | Joint Chiefs of Staff |
| JDA | Joint Deployment Agency |
| JPAM | Joint Program Assessment Memorandum |
| KEE | Knowledge Engineering Environment (Intellicorp propiertary software) |
| LAD | latest arrival date |
| LOTS | logistics over the shore |
| MAC | Military Airlift Command |

| | |
|---|---|
| MAPS | Mobilization Asset Planning System |
| MIDAS | Model for Intertheater Deployment by Air and Sea |
| MMC | Materiel Management Center |
| MOB | mobilization |
| MODES | Mode Optimization and Delivery Estimation System |
| MSC | Military Sealift Command |
| MTMC | Military Traffic Management Command |
| NATO | North Atlantic Treaty Organization |
| NICP | national inventory control point |
| ODCSLOG | Office of the Deputy Chief of Staff for Logistics |
| ODCSOPS | Office of the Deputy Chief of Staff for Operations and Plans |
| OMNIBUS | US Army Operational Readiness Analysis |
| OSD | Office of the Secretary of Defense |
| PAX | passenger(s) |
| PFT | Program Force Type Unit Characteristics File |
| POMCUS | prepositioning of materiel configured to unit sets |
| POD | port of debarkation |
| POE | port of embarkation |
| POR | processing overseas replacements for movement |
| PSM | professional staff month(s) |
| RAPIDSIM | Rapid Intertheater Deployment Simulation |
| RDD | required delivery date |
| SEACOP | Strategic Sealift Contingency Planning System |
| SIMKIT | Intellicorp proprietary software |
| SITAP | Simulation for Transportation Analysis and Planning |
| SPOD | seaport of debarkation |

| | |
|---|---|
| SPOE | seaport of embarkation |
| SRA | Support Requirements Analysis |
| STRATMOB | strategic mobility |
| SUMMITS | Scenario Unrestricted Mobility Model for Intratheater Simulation |
| SWA | Southwest Asia |
| TOE | table of organization and equipment |
| TPFDD | Time-Phased Force Deployment Data |
| TRANSMO | Transportation Model |
| TUCHA | Type Unit Characteristics File |
| UIC | unit identity code |
| UE | unit equipment |
| UFSS | Ultra Fast Sealift Study |
| USAF | United States Air Force |
| WWMCCS | Worldwide Military Command and Control System |

END
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